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ABSTRACT

To determine the degree of emphasis on phonics instruction necessary for beginning readers, a study was conducted involving five pairs of four-year-old monozygotic twins. Randomly selected twins from each pair were exposed to two different levels of phonics instruction. In one group, the reduced treatment group, only one sound equivalent per letter was taught. In the full treatment group, a vowel digraph, a diphthong, and a long vowel sound were taught, in addition to the sound equivalents taught to the reduced treatment group. Analysis of the data demonstrated highly significant differences in the number of test trials that it took for the two groups to decode three phonemic sets of words. Twins taught only one sound value per letter needed fewer test trials to decode words than did their siblings whose experience included learning variable grapheme/phoneme correspondences. (Author/FL)

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Determining the Minimum Amount of Phonetic Analysis Needed for Word Decoding Using the Co-twin Method*

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Introduction

The present study is an attempt to determine the degree of emphasis on phonics instruction necessary for beginning readers. The objective was to ascertain whether differences existed in the facility with which words were decoded initially by children exposed to different amounts of phonics instruction. Language acquisition research and the Piagetian notion pointing to the capacity of young children to self-structure initially amorphous stimuli provided the primary rationale for the study.

Background and rationale

Present evidence indicates that phonics in beginning reading programs will, in all probability, continue (Aukerman, 1975). The new anti-phonics movement notwithstanding, Groff (1977) predicts that phonics will remain a significant aspect of beginning reading instruction in the foreseeable future.

But while there appears to be general agreement on the importance of phonics (Bond and Dykstra, 1967; Chall, 1967; Gurren and Hughes, 1965), issues regarding the timing and method of phonics instruction, as well as the degree of emphasis remain unsettled (Gleitman and Rozin, 1973; Inselberg, 1972; Neubauer, 1977). One specific problem is determining the optimum amount of letter-analysis in beginning reading. As Gleitman and Rozin (1973) pointed out, "We do not know how little must be taught of decoding principles to teach a child to read." Gurren and Hughes (1965) recommended that all the main sound-symbol relationships, including both vowels and consonants, be taught intensively from the start. Using adult subjects in experiments simulating children's early learning, Levin, Baum, and Bostwick (1963) found that transfer of learning was facilitated by initial teaching which involved variable medial sound-letter correspondences.

In a more recent study, Ackerman (1973) also found that initial training was more effective for transfer when it involved variable grapheme-phoneme correspondence in the case of the vowel a. On the other hand, Clymer (1963) who studied 45 phonic generalizations found only 18 to be useful. He pointed out that phonic programs representing large numbers of generalizations were open to question. Featherstone, in a private communication (Downing, 1972), strongly objected to compelling children to memorize the 45 phonemes of i.t.a., a spectacle, he considered, which should be condemned.

Some cognitive theorists (Ausubel and Robinson, 1969; Fowler, 1969; Kohlberg, 1968) suggest that the cognitive processes involved in learning to read are modest, compared with the cognitive-structural transformations associated with the development of language normally taking place at age two or three years. Language studies have demonstrated (Brown, 1973) that by age three, a child's speech is governed by an implicit grammatical system, whereby existent regularities are overgeneralized, subsuming irregular patterns and giving rise to systematic errors. With expanding experience, the rules are revised and more accurate differentiations made. Gibson and Levin (1975) propose that concepts which have proven useful in understanding language acquisition, such as self-structuring of initially amorphous stimuli and rule induction, or the reduction to the basic patterns and order by the young child, be applied to our quest for understanding the process of learning to read. Writing from a Piagetian standpoint, Wadsworth (1978) argues for a reading program that allows children

to break the reading code by having them construct the organization of written symbols, in much the same manner that they construct the organization of the spoken language.

Applying the theoretical framework of language acquisition research to reading acquisition research, Lucas (1974) found that beginning readers do in fact make systematic errors in decoding. She further noted the apparent resistance in the young reader to shifting from a single-letter-single-sound strategy to a letter-cluster strategy, until the former strategy has failed and the beginning reader has acquired a sense of what alternative strategy could be substituted.

In applying the above concepts used for understanding language acquisition to the teaching of reading, we questioned the necessity of formally teaching beginning young readers all the letter-sound relationships in order to facilitate their decoding of unfamiliar words. It was hypothesized in this study that the ability to decode words is facilitated when the beginning reader is taught only one sound for a given vowel or consonant. The one sound corresponding to a letter may, therefore, be considered an overgeneralization. With more experience in reading and exposure to other frequently occurring letter-sound equivalents, the original rules which represent overgeneralizations would be revised and supplemented by the child, without being formally given specific rules. Consider the child who has learned how to blend one initial consonant with a vowel, as well as a vowel with a terminal consonant, and who has also made the overgeneralizations that the vowel a has an [æ] sound and i an [ɪ] sound. When the word rain is first encountered, the child might decode it by uttering r-æ-ɪ-n. However, if he already knows the word rain, or with proper teacher feedback, he would reconstruct the pronunciation r-æ-ɪ-n to match the spoken word rain. With increasing empirical

experience with the digraph ai, he would induce the principle that ai has a sound of [ey], although, he may not, in most likelihood, be able to verbalize it. He would, therefore, modify the overgeneralization that a always has an [æ] sound, so as to encompass the detail ai, although again he would not be conscious of any hierarchical order. Because the overgeneralization concerning the vowel a would already be a part of his cognitive structure, retention of the principle regarding ai would be facilitated by correlative subsumption (Ausubel and Robinson, 1969).

The preceding hypothetical formulations provided the rationale for the design of the present study. Specifically, the study was an attempt to identify conditions which might facilitate self-structuring on the part of the beginning reader. The objective was to determine whether any differences existed in the facility with which words were decoded initially by children exposed to different amounts of phonics instruction. While this objective has been a focus of past studies, the present study employed monozygotic twins, thereby facilitating the control of variability in the subjects. In addition, several graphemes were considered.

Method

Subjects

The subjects were five sets of monozygotic twins identified from birth records and applications for admission to a university nursery school. The mean age at the initiation of the study was 52 months, and all subjects were attending nursery school at the time of the study. Four sets were males, and all five sets came from either professional families or had fathers who were skilled workers. None of the mothers were employed.

A statement confirming monozygosity in all but one case was obtained from the family pediatrician. All had no apparent physical speech defects and had normal vision and hearing.

A twin of each pair was assigned at random to either of two experimental treatments. Pretesting indicated that both groups had WPPSI Full IQ levels which were similar and within the range of normality, the average IQ being 109 for the full treatment group and 105 for the reduced treatment group (See Procedure for the definition of the two groups). Also, no significant differences were noted between the groups in their pretest ITPA subscores.[1]

Procedure

As noted above, a twin of each pair was assigned at random to either of two experimental treatments. After initial adjustment to the nursery school and establishment of rapport, both groups were given instruction in word decoding utilizing the phonics approach. Each twin was taught individually, twice a week, for 10 minutes per session. In one group, the reduced treatment group (R group), only one sound equivalent per letter was taught, while in the full treatment group (F group), a vowel digraph (ai), a diphthong (ou), and a long vowel sound ($\bar{i}$) were taught, in addition to the sound equivalents taught to the R group. All sounds taught occurred in test words to be decoded later. The specific steps followed were:

1. The sound equivalents for the consonants s, l, p, r, n, h, t, m, d, e.g. [si], in the sequence given, and the short sounds for each of the vowels, except for o, were taught to both groups. The long o sound was taught in order to allow for greater differentiation from the short u sound. One new sound was taught at a time and only after it was ascertained that previously taught sounds had been mastered. The sound value of a letter was first uttered

by the experimenter and repeated by the subject. Flash cards, lotto, and a magnetic board with letters, were used for practice games. For example, the experimenter would say, "M is hiding in this pile of cards from you. Can you find it?" The subject would then locate the letter m and utter its sound, with the experimenter's help if needed. Letter names were not taught, but letters were identified by their corresponding sounds instead. The experimenter and the children also acted out the shapes of the letters. At the termination of this segment of the study, each child was tested for his mastery of all the given sounds. Three by five inch cards, with a given letter printed on a card, were flashed and the child was asked to pronounce the sound associated with each letter. Mastery was indicated when he was able to pronounce all the sounds. No child was exposed to the next step unless he had manifested mastery.

2. When the above sounds were mastered, the children were taught how to blend an initial consonant and a vowel, as well as a vowel and a terminal consonant. Decoding three-letter monosyllabic words, such as man and sit, followed. Again, flash cards, lotto, a magnetic board with letters, as well as matching pictures with words were devices used for practice games. Mastery of these steps was determined by testing each child. The words hat, mat, hit, lid, run, sun, net, pet, no, and ho were each printed on 3 x 5 inch cards and shuffled. Each card was flashed and the child was asked to pronounce each

word. Mastery was indicated when a child could pronounce all words.

3. Following mastery of the preceding steps, the experimental treatments began.[2] The F group was taught the experimental sounds ai, ou and ī needed for decoding the test words, while the R group was given a placebo treatment of learning the sound equivalents of the consonants b, f, and z, which were not included in any of the test words.

At the beginning of each training period for decoding words with a particular experimental sound, each child was presented a group of three monosyllabic words containing the particular experimental sound printed on 3 x 5 inch cards, in the context of a guessing game. The test words were rain, pail, and sail for the digraph ai; out, our and house for the diphthong ou; and time, dime and side for the long sound ī. The words were chosen at random from a primer. None of the children could decode the words initially. The object was to determine the number of test trials it took for a child to learn to decode all the words from a given phonemic group. The degree of facility in decoding words was, therefore, defined as the number of test trials needed to decode words containing the experimental sound, with fewer test trials reflecting greater facility. The order of presentation of the words was changed at random at every trial which was made to appear as a guessing game. A word was recorded as having been decoded correctly only when there were no errors in pronouncing it. Under no circumstances was verbal feed-back ever given by the tester. After a child had decoded all three words

in a group for the first time, the test trials and instruction were continued for three more sessions, in order to demonstrate with certainty that the child could decode all three words. The total number of test trials needed for the subject to decode all words in a given set, for the first time was, however, the value used in the analysis of the data.

Each session was started with a test trial, followed by instruction. The F group was taught an experimental sound and how to blend it with other already learned sound equivalents to form a test word. To illustrate, in decoding the word rain, the F group was first taught the [ey] sound equivalent of ai and then, how to blend it with the initial consonant [r] and terminal consonant [n] to form [reyn]. With regard to words containing the long i sound, they were taught that i in such words was pronounced [ay] and the terminal e was silent, as in the case of [taym]. [æw] as an equivalent sound of ou was also taught. In the case of the test word house, they were told that the terminal e was silent. Thus, it can be noted that specific rules were taught to this group. During each session, the blending of sounds and the proper pronunciation for each word was demonstrated three times and each time the child repeated blending the sounds and pronouncing the word himself.

The R group, on the other hand, was not specifically taught the sound equivalents of ai, ou, and ī. The children in this group were given instruction in decoding the test words simply by utilizing sound equivalents already learned, although new consonant sounds, indicated above, were taught as a placebo treatment. In addition, whenever a consonant and vowel or a

vowel and consonant could be blended in decoding a word, such a skill was utilized, as it was already manifested by the children. To illustrate, in decoding the test word pail, the experimenter first divided the word into two "syllables," namely, p æ and ɪ l, by covering each syllable at a time. With the help of the experimenter, if needed, the child was asked to pronounce each syllable. Then sliding the two syllables together twice with increasing speed, the proper pronunciation was brought forth by the experimenter on the second try, with the child repeating the sounds in each case. By no means was the impression conveyed or were the children told that, by sliding [æ] and [ɪ] together fast, the spoken [ey] is obtained. Again, the rationale for not formally teaching this group highly differentiated rules and, therefore, sounds, was the assumption that such a condition would facilitate self-structuring or assimilation and, therefore, retention on the part of the preliterate children. As an example of how a test word containing ou was decoded, the word our was first segmented by the experimenter into component sounds already known to the children: [o], [ʌ] and [r], a procedure similar to that followed with regard to words containing ai. The three sounds, in the proper order, were uttered with increasing speed twice and, at the second utterance, the proper pronunciation of our [æ wr] was brought forth by the experimenter, with the child repeating the utterance in every instance. The word time, being an example of a word containing [ī], was initially decoded as [tɪ-mɛ]. The two syllables were combined with greater speed and, at the second

utterance, the proper pronunciation was advanced by the experimenter. At no time were the children told that the terminal e in words containing [ī] was silent.

All instruction was given in the context of games, so as to enhance the interest of the children. The experimenter and subject also talked about the test words, for instance, what happens when it rains, or used them in sentences. An example of a practice game follows: A child chose a toy jet plane from a collection of jet planes and was asked to land or take off from a given landing strip, depending on the instructions given by the air traffic controller, a role played by the experimenter. At all times, there were three landing strips, each one identified by an experimental word from a phonemic group. At a certain stage of the experiment, for example, the landing strips were labeled rain, pail and sail. Excitement or a sense of urgency was created by the experimenter by speaking fast when necessary, and by indicating emergency situations needed for landing. Excitedly, the experimenter would say, "Pilot, pilot of the yellow (or whatever the color chosen) jet plane! There is a snowstorm coming and you must land immediately! Land on the landing strip called pail!" If the child landed on the correct strip, verbal reinforcement was given. If not, the correct landing strip was identified, and the experimenter demonstrated how the word would be decoded, using the procedures given above and according to whether the child was from the F or R group.

In analyzing the data, the sig test (Siegel, 1956) was applied to determine the significance of differences in the number of test trials that it took for the F and R groups to decode the three sets of words, one set containing ai, the second set, ou, and the third containing ī.

Results

Analysis of the data, using the sign test, demonstrated highly significant differences in the number of test trials that it took for the F and R groups to decode three phonemic sets of words, each containing either ai, ou, or ī. In a total of 15 intersibling comparisons (3 sets of words per pair x 5 pairs) to determine which twin in a given pair required less time to decode, it was found that the R group took less time in learning to decode the words: they needed fewer test trials in 12 cases, an equal number of trials in 2 cases, and a greater number of trials in only one case ($p < .003$). The frequency distribution of the number of test trials for the two groups is presented in Table 1. In almost all instances (93 percent), the R group took nine trials or less to decode the sets of words, while the corresponding percentage for the F group was 53 percent. Analyzing further the number of trials it took for each child to decode each word (3 sets x 3 words x 5 children, totaling 45 comparisons), the R group took fewer trials in 32 instances, performed equally well in seven cases, and needed more trials in only six instances ($p < .0003$).

(Table 1 about here)

In order to obtain assurance that the basic comparability of the two groups of children in linguistic abilities had remained the same throughout the experimental period and the differences indicated above were, in all probability, due to the treatments, the ITPA was again administered to the subjects

at post-time. No differences were noted between the R and F groups in their mean age gain scores on the various subtests given.[3]

Discussion

The study provides evidence in support of teaching limited phonics rather than all main sound-symbol equivalents to beginning young readers. The findings are in accord with the hypothesis that initial word decoding by beginning readers is facilitated when only one sound for a given letter is formally taught at the start. The teaching of specific rules did not even result in a similar rate of facility in learning to decode. Less time was taken to decode words by the twins who were taught only one sound per vowel or consonant than by their siblings who were taught a long vowel sound, vowel digraph, and diphthong, in addition to the sounds taught to the former. It appears, therefore, that there would be merit in investigating further the application of recognized mechanisms for language acquisition used by the young child in order to facilitate initial word decoding: "overgeneralizations" would be encouraged, while modifications and refinements of the "general rule" would not be formally taught but would be left to be induced by the child, with expanded experience. As pointed out by Reid (1972), the process of learning to read requires logical operations, including an understanding of hierarchical structure in its simplest form on the part of the young child. Determining how to "decomplicate" the teaching of reading to a prelogical child by taking advantage of processes that the child has already used in simplifying his learning of a complicated system of oral language would be a continuing worthwhile subject for investigation.

As is now well known to students of Piaget (1964), the abiliy to master multiplicative classification does not come about for many children until the age of seven or eight years. Therefore, in consonance with the Piagetian notion,

one would expect many young children who may still be at the preoperational stage to learn with difficulty when many letters in the alphabet are presented as each having two or more possible pronunciations or sound properties. Downing (1972) admonished that the teaching of reading to children below seven or eight should utilize the children's natural thinking process in generating understanding and that the teaching of verbal rules is worse than unnecessary. Mason (1977) found that word learning was positively associated with a multiple classification ability among preschool children.

Since the sample was small, the statistical analysis took into account the several sets of test words that each child had to decode, resulting in a statistically meaningful number of comparisons. While the probability values obtained indicated highly significant differences in favor of limited phonics instruction in initial learning of word decoding, it is evident that much more research will be needed before firm conclusions can be drawn. Ackerman's findings with kindergartners (1973) showing greater effectiveness for transfer when teaching both short and long sounds of the vowel a, rather than only its short sound, is a case in point. Whether the more important variable is the cognitive level of the subjects, relative to their ability to handle multiple properties and "exception," or the particular letter selected, remains to be dealt with in further studies. Also, determining whether the findings obtained in the present study would hold when decoding words constituted with other vowel sounds and combinations thereof, as well as consonants with more than one sound, consonant digraphs, and silent letters, should be a fruitful area of investigation.

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Footnotes

[1]The mean age scores in months on the subtests given to the full treatment group were 62.2 for auditory reception, 55.8 for visual reception, 57.4 for auditory association, 57.4 for visual association, 39.4 for auditory memory, and 53.8 for visual memory. The corresponding mean age scores for the reduced treatment group were 61.4, 53.2, 53.0, 65.4, 41.8 and 46.6. *t*-tests were employed to test for significance of differences.

[2]The study followed the university academic year. The first two steps were conducted, for the most part, during the first semester. The subsequent steps were carried out for the most part during the second semester. No child was exposed to the experimental treatment unless he had shown mastery of the first two steps.

[3]The posttest mean age scores in months on the subtests given to the F group were 61.8 for auditory reception, 69.4 for visual reception, 67.4 for auditory association, 70.8 for visual association, 52.4 for auditory memory, and 76.8 for visual memory. The respective mean age scores for the R group were 64.0, 85.4, 68.6, 73.8, 52.8 and 61.6. t-tests were performed to test for the significance of differences in the mean age gain scores. Posttests were administered after the academic year, at which time the mean age of the Ss was 62 months.

Table 1: Number of test trials to decode three sets of words with two levels of phonics instruction

Trials	Reduced N=15	%	Full N=15	%
4 or less	6	40	3	20
5-9	8	53	5	33
10-14	1	7	5	33
15 or more			2	13